

CLAIMS

What is claimed is:

1. An apparatus for short flange forming, the apparatus comprising:
a nest for holding a first sheet material;
a robotic arm operatively associated with said nest; and
a forming steel assembly operatively associated with said robotic arm for forming a short flange on a sheet material.
2. The apparatus of Claim 1 wherein said forming steel assembly comprises a positional pressure forming steel assembly operatively associated with said robotic arm.
3. The apparatus of Claim 2 wherein the positional pressure forming steel assembly further comprises a cylinder and a hub supported within said cylinder for relative sliding movement.
4. The apparatus of Claim 3 further including a biasing element interposed between said cylinder and said hub.
5. The apparatus of Claim 4 wherein said biasing element is a spring.

6. The apparatus of Claim 1 wherein said forming steel assembly comprises an extension extending outwardly therefrom and a tool steel disposed on an end of said extension.

7. The apparatus of claim 6 wherein said robotic arm rotatably supports said forming steel assembly.

8. The apparatus of Claim 7 wherein said forming steel assembly further comprises a second extension extending outwardly therefrom and a second tool steel disposed on an end of said second extension.

9. The apparatus of Claim 6 wherein said extension comprises a tiered extension having said first tool steel disposed on an outer portion of said extension and a second tool steel disposed on an inner portion of said extension.

10. The apparatus of Claim 1 wherein said forming steel assembly comprises a roller rotatably supported on an end thereof.

11. The apparatus of Claim 10 wherein said forming steel assembly comprises a positional pressure forming steel assembly operatively associated with said robotic arm.

12. The apparatus of claim 10 wherein said nest comprises a guide surface, said roller selectively engagable with said guide surface to orientate said forming steel assembly with respect to said nest.

13. The apparatus of claim 1 wherein said robotic arm rotatably supports said forming steel assembly.

14. An apparatus for forming and joining a first sheet material to a second sheet material, the first sheet material having a periphery, the periphery having a contour, the apparatus comprising:

a nest for holding a first sheet material, said nest including a material-contacting portion;

a forming and joining assembly operatively associated with said nest, said assembly including a robotic arm and a forming steel assembly having a tool steel which forms a short flange on said first sheet material by bending said short flange onto said second sheet between said tool steel and said material contacting portion; and

a computer operatively associated with said forming and joining assembly, said computer having a tool-driving program.

15. The apparatus of Claim 14 wherein said forming steel assembly comprises a positional pressure forming steel assembly operatively associated with said robotic arm.

16. The apparatus of Claim 15 wherein said forming steel assembly further comprises a cylinder and a hub supported within said cylinder for relative sliding movement.

17. The apparatus of Claim 16 further including a biasing element interposed between said cylinder and said hub.

18. The apparatus of Claim 17 wherein said biasing element is a spring.

19. The apparatus of Claim 14 wherein said forming steel assembly comprises an extension extending outwardly therefrom and said tool steel disposed on an end of said extension.

20. The apparatus of claim 19 wherein said robotic arm rotatably supports said forming steel assembly.

21. The apparatus of Claim 20 wherein said forming steel assembly further comprises a second extension extending outwardly therefrom and a second tool steel disposed on an end of said second extension.

22. The apparatus of Claim 14 wherein said extension comprises a tiered extension having said first tool steel disposed on an outer portion of said extension and a second tool steel disposed on an inner portion of said extension.

23. The apparatus of Claim 14 wherein said forming steel assembly comprises a roller rotatably supported on an end thereof.

24. The apparatus of Claim 23 wherein said forming steel assembly comprises a positional pressure forming steel assembly operatively associated with said robotic arm.

25. The apparatus of claim 23 wherein said nest comprises a guide surface, said roller selectively engagable with said guide surface to orientate said forming steel assembly with respect to said nest.

26. The apparatus of claim 14 wherein said robotic arm rotatably supports said forming steel assembly.

27. A method for forming a first sheet material with a periphery having a contour, the method comprising:

holding a first sheet material in a nest such that a periphery of said first sheet material is supported on a material contacting portion of said nest;

locating a robotic arm having a forming steel assembly relative to said nest such that a tool steel engages a flange extending from said periphery; and

manipulating said robotic arm to move said forming steel assembly along a tool path such that said tool steel forms said flange over said periphery of said first sheet material.

28. The method of Claim 27 further comprising executing a forming steel-driving program in a controller to manipulate said robotic arm.

29. The method of Claim 27 further comprising manipulating the position of said robotic arm relative to said nest to apply a predetermined pressure between said tool steel and said material contacting portion.

30. The method of Claim 29 wherein said applied pressure is varied along said tool path by positioning said forming steel assembly relative to said material contacting portion in a direction normal to said tool path.

31. The method of Claim 27 further comprising:

re-locating said robotic arm such that a second tool steel engages said flange extending from said periphery; and

manipulating said robotic arm to move said forming steel assembly along a second tool path such that said second tool steel forms said flange over said periphery.

32. The method of Claim 27 further comprising:

re-locating said robotic arm such that a roller engages said flange extending from said periphery; and

manipulating said robotic arm to move said roller along a second tool path such that said roller forms said flange over said periphery.

33. The method of claim 32 wherein a portion of said first tool path overlaps with a portion of said second tool path such that said tool steel performs a preforming operation and said roller performs a final forming operation.

34. The method of claim 32 wherein said first tool path is distinct from said second tool path such that said tool steel forms a first portion of said flange and said roller forms a second portion of said flange.